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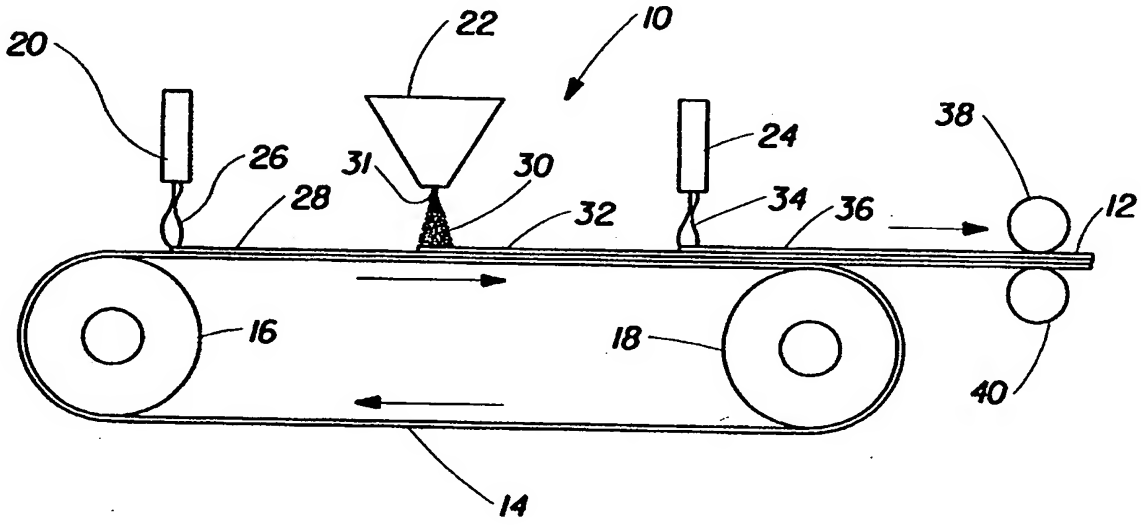

(57) Abstract

The present invention discloses a lightweight nonwoven laminate particularly useful as a component of personal care articles, for example as a barrier cuff material for disposable diapers. Components of the laminate include at least one fine fiber layer having a basis weight in the range of from abouth 1.5 gsm to 26 gsm and at least one continuous filament layer having a basis weight of less than about 4.8 gsm. The fine fiber component comprises at least a ratio of 5 % and the layers are intermittently bonded for a total basis weight up to about 20 gsm. Desirable softness, breathability and barrier properties are obtained.

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DISPOSABLE ABSORBENT ARTICLE WITH IMPROVED CONTAINMENT MEANS

FIELD OF THE INVENTION

The present invention relates to disposable absorbent articles such as disposable diapers, training pants, incontinence briefs, incontinence pads, incontinence undergarments, diaper holders and liners, feminine hygiene garments, and more particularly, to such disposable absorbent articles having improved containment means.

BACKGROUND OF THE INVENTION

Nonwoven fabric laminates are useful for a wide variety of applications. Such nonwoven fabric laminates are useful for wipers, towels, industrial garments, medical garments, medical drapes, and the like. In heavier basis weights the laminates may be used in recreational applications such as tents and as car covers. Disposable fabric laminates have achieved especially widespread use in hospital operating rooms for drapes, gowns, towels, footcovers, sterilization wraps, and the like. Such surgical fabric laminates are generally spunbonded / meltblown / spunbonded (SMS) laminates consisting of nonwoven outer layers of spun-bonded polyolefins and an interior barrier layer of melt-blown polyolefins. Such SMS fabric laminates have outside spunbonded layers which are durable and an internal melt-blown barrier layer which is porous but which, in combination with the spunbond layers, inhibits the strikethrough of liquids from the outside of the fabric laminate to the inside. In order for such a fabric to perform properly, it is necessary that the melt-blown barrier layer have a fiber size and a porosity that assures breathability of the fabric while at the same time inhibiting strikethrough of liquids.

Personal care absorbent articles such as disposable diapers, training pants, incontinent wear and feminine hygiene products utilize nonwoven fabrics for many purposes such as liners, transfer layers, absorbent media, backings, and the like. For many such applications the barrier properties of the nonwoven play an important role such as, for example, as containment flaps or barrier cuffs described in U.S. Pat. No. 4,909,803 issued to Aziz et al. on March 20, 1990, U.S. Pat. No. 4,795,454 issued to Dragoo on January 3, 1989, and U.S. Pat. No. 4,695,278 issued to Lawson on September 22, 1987, each of which is incorporated herein by reference. As described therein,

disposable absorbent articles utilized for the absorption and containment of urine or other body exudates generally comprise a liquid pervious topsheet, a fluid impervious backsheet joined to the topsheet, an absorbent material or absorbent core disposed therebetween, and can be provided with improved containment by means of barrier cuffs. It is also desirable for personal care product applications such as barrier cuffs that the nonwoven fabric be soft and conformable and that the porosity of the fabric provide a level of breathability for increased comfort. As cost is always a factor, the ability to provide these benefits at low cost is another consideration.

Although nonwoven laminates having some combination of the properties desired have been available, they have not been widely utilized for applications such as the aforementioned cuffs because one or more of the important considerations has been lacking or not present to a desired degree. The present invention is directed to improved nonwoven laminates satisfying those and other desired requirements.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings.

SUMMARY OF THE INVENTION

The present invention is directed to improved nonwoven laminates which can be made in extremely light weights and include at least one fine fiber component layer and at least one continuous filament layer. The fine fiber layer includes fibers having an average diameter in the range of from about 2 microns to about 12 microns and a basis weight in the range of from about 1.5 gsm to about 26 gsm. The continuous filament web has filaments with an average diameter in the range of from about 10 microns to about 30 microns and a basis weight less than about 4.8 gsm. The layers are bonded intermittently for a total basis weight not to exceed about 20 gsm and with the ratio of fine fibers to continuous filaments at least 5%. The resulting laminate has an improved combination of properties including softness and conformability, for certain applications a barrier as measured by hydrostatic head of at least 50 mm, and breathability as measured in terms of Frazier porosity of at least 50 scfm. Preferred embodiments are described below and include spunbond continuous filament webs and meltblown fine fiber webs as the respective layers.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which like designations are used to designate substantially identical elements, and in which:

FIG. 1 is a schematic diagram of a forming machine which is used in making the nonwoven fabric laminate including the melt-blown barrier layer of the present invention;

FIG. 2 is a cross-section view of the nonwoven fabric laminate of the present invention showing the layer configuration including the internal fine fiber barrier layer made in accordance with the present invention;

FIG. 3 is a cross-section view of an alternative embodiment of the nonwoven fabric laminate of the present invention in a two layer configuration;

FIG. 4 is a cross-section view of a third embodiment of the nonwoven fabric laminate of the present invention with external fine fiber layers; and

FIG. 5 is a perspective view of a disposable diaper.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to improved lightweight nonwoven laminates including at least one fine fiber component layer and at least one continuous filament layer. Preferred embodiments include spunbond continuous filament webs and meltblown fine fiber webs as the respective layers. The fine fiber layer generally includes fibers having an average diameter in the range of from about 2 microns to about 12 microns and a basis weight in the range of from about 1.5 gsm to about 26 gsm. For applications in disposable personal care products, the average fine fiber diameter will generally be in the range of from about 6 microns to about 11 microns, and the fine fiber web basis weight will be in the range of from about 1.5 to about 10 gsm. The continuous filament web has filaments with an average diameter in the range of from about 10 microns to about 30 microns and a basis weight of less than about 4.8 gsm. For

disposable personal care product applications, the continuous filaments generally have an average diameter in the range of from about 18 microns to about 25 microns and a basis weight in the range of from about 4 gsm to about 4.6 gsm with 4.5 gsm being preferred. The layers are bonded intermittently for a total basis weight not to exceed about 20 gsm and with the amount of fine fibers based on the laminate weight of at least 5%. Advantageously for disposable personal care product applications, the laminate basis weight in accordance with the invention is extremely low and within the range of up to about 15 gsm and the fine fibers constitute a low proportion of the laminate in the range of about 5% to about 25%. The resulting laminate has an improved combination of properties including softness and conformability, when desired a barrier as measured by hydrostatic head of at least about 40mm, preferably at least about 50mm, and more preferably at least about 70 mm. The laminate preferably also has a breathability, as measured in terms of Frazier porosity, of at least 50 scfm. Thus, in accordance with the present invention, a three layer laminate has been made on commercial equipment combining two continuous filament layers of 4.5 gsm where the fibers have an average diameter of about 20 microns each with a middle fine fiber layer of 2.0 gsm where the fibers have an average diameter of about 12 microns.

The foregoing objectives are preferably obtained by forming a melt-blown web from a propylene polymer resin having a broad molecular weight distribution. In general, the present invention may start with a propylene polymer in the form of reactor granules which polymer has a molecular weight distribution of 3.6 to 4.8 Mw/Mn, advantageously 3.6 to 4.0 Mw/Mn and a melt flow rate of about 400 gms/10 min to 3000 gms/10 min at 230°C. Particularly advantageous embodiments for disposable personal care applications include a polypropylene resin in the form of a reactor granule having a starting molecular weight distribution of about 3.6 to about 4.8 Mw/Mn and a melt flow rate of from about 600 to about 3000 gms/10 min. at 230°C.

Alternatively, an improved fine fiber web for use as a barrier layer can be formed by utilizing a resin, particularly polypropylene, having a narrow molecular weight distribution and having a lower melt flow rate. The starting reactor granule polypropylene resin in this case has a molecular weight distribution between about 4.0 and about 4.8 Mw/Mn and a melt flow rate ranging from about 400 to about 1000 gms/10 min. at 230°C. The polypropylene resin has a melt flow rate, up to about 3000 gms/10 min. at 230°C. and a narrow molecular weight distribution of about 2.2 to about 2.8 Mw/Mn, for example.

Turning to FIG. 1, there is shown schematically a forming machine 10 which may be used to produce an improved nonwoven fabric laminate 12 having a fine fiber meltblown barrier layer 32 and outer continuous filaments layer 28 in accordance with the present invention. Particularly, the forming machine 10 consists of an endless foraminous forming belt 14 wrapped around rollers 16 and 18 so that the belt 14 is driven in the direction shown by the arrows. The forming machine 10 has three stations, spun-bond station 20, melt-blown station 22, and spun-bond station 24. However, it should be understood that more than three forming stations may be utilized to build up layers of higher basis weight. Alternatively, each of the laminate layers may be formed separately, rolled, and later converted to the fabric laminate off-line. In addition, the fabric laminate 12 could be formed of more than or less than three layers depending on the requirements for the particular end use for the fabric laminate 12. For example, for some applications it may be preferred to have at least two inner meltblown layers for improved performance and for extremely lightweight applications a two-layer laminate may be made.

The spunbond stations 20 and 24 may be conventional extruders with spinnerets which form continuous filaments of a polymer and deposit those filaments onto the forming belt 14 in a random interlaced fashion. The spun-bond stations 20 and 24 may include one or more spinnerets heads depending on the speed of the process and the particular polymer being used. Forming spunbonded material is conventional in the art, and the design of such a spunbonded forming station is thought to be well within the ability of those of ordinary skill in the art. The nonwoven spunbonded webs 28 and 36 are prepared in conventional fashion such as illustrated by the following patents: Dorschner et al. U.S. Pat. No. 3,692,618; Kinney U.S. Pat. Nos. 3,338,992 and 3,341,394; Levy U.S. Pat. No. 3,502,538; Hartmann U.S. Pat. Nos. 3,502,763 and 3,909,009; Dobo et al. U.S. Pat. No. 3,542,615; Harmon Canadian Patent No. 803,714; Matsuki et al., U.S. Pat. No. 3,802,817 and Appel et al. U.S. Pat. No. 4,340,563. Other methods for forming a nonwoven web having continuous filaments of a polymer are contemplated for use with the present invention.

Spunbonded materials prepared with continuous filaments generally have at least three common features. First, the polymer is continuously extruded through a spinneret to form discrete filaments. Thereafter, the filaments are drawn either mechanically or pneumatically without breaking in order to molecularly orient the polymer filaments and achieve tenacity. Lastly, the continuous filaments are deposited in a substantially

random manner onto a carrier belt to form a web. Particularly, the spunbond station 20 produces spun-bond filaments 26 from a fiber forming polymer. The filaments are randomly laid on the belt 14 to form a spunbonded external layer 28. The fiber forming polymer is described in greater detail below.

The meltblown station 22 consists of a die 31 which is used to form microfibers 30. The throughput of the die 31 is specified in mounds of polymer melt per inch of die width per hour (PIH). As the thermoplastic polymer exits the die 31, high pressure fluid, usually air, attenuates and spreads the polymer stream to form microfibers 30. The microfibers 30 are randomly deposited on top of the spunbond layer 28 and form a meltblown layer 32. The construction and operation of the meltblown station 22 for forming microfibers 30 and meltblown layer 32 is considered conventional, and the design and operation are well within the ability of those of ordinary skill in the art. Such skill is demonstrated by NRL Report 4364, "Manufacture of Super-Fine Organic Fibers", by V. A. Wendt, E. L. Boon, and C. D. Fluharty; NRL Report 5265, "An Improved Device for the Formation of Super-Fine Thermoplastic Fibers", by K. D. Lawrence, R. T. Lukas, and J. A. Young; and U.S. Pat. No. 3,849,241, issued Nov. 19, 1974, to Buntin et al. Other methods for forming a nonwoven web of microfibers are contemplated for use with the present invention.

The meltblown station 22 produces fine fibers 30 from a fiber forming polymer which will be described in greater detail below. The fibers 30 are randomly deposited on top of spunbond layer 28 to form a meltblown internal layer 32. For a barrier flap fabric laminate, for example, the meltblown barrier layer 32 generally has a basis weight of about 1.5 gsm to about 26 gsm, and advantageously for disposable personal care products from about 1.5 gsm to about 10 gsm. In accordance with the present invention, a preferred embodiment of a meltblown web formed in accordance with U.S. Pat. No. 5,213,881 to Timmons, Kobylivker and Woon dated May 25, 1993, incorporated herein by reference, is utilized as the fine fiber component or components.

After the internal layer 32 has been deposited by the meltblown station 22 onto layer 28, spun-bond station 24 produces spunbond filaments 34 which are deposited in random orientation on top of the melt-blown layer 32 to produce external spunbond layer 36. For a barrier flap fabric laminate for a disposable diaper, for example, the layers 28 and 36 each have a basis weight of less than about 4.8 gsm, preferably about 4.5 gsm.

The resulting SMS fabric laminate web 12 (FIG. 2) is then fed through bonding rolls 38 and 40. The surfaces of one or both of the bonding rolls 38 and 40 are provided with a raised pattern such as spots or grids. The bonding rolls are heated to the softening temperature of the polymer used to form the layers of the web 12. As the web 12 passes between the heated bonding rolls 38 and 40, the material is compressed and heated by the bonding rolls in accordance with the pattern on the rolls to create a pattern of discrete areas, such as 41 shown in FIG. 2, which areas are bonded from layer to layer and are bonded with respect to the particular filaments and/or fibers within each layer. Such discrete area or spot bonding is well-known in the art and can be carried out as described by means of heated rolls or by means of ultrasonic heating of the web 12 to produced discrete area thermally bonded filaments, fibers, and layers. In accordance with conventional practice described in Brock et al., U.S. Pat. No. 4,041,203, it is preferable for the fibers of the meltblown layer in the fabric laminate to fuse within the bond areas while the filaments of the spun-bonded layers retain their integrity in order to achieve good strength characteristics. For heavier basis weight laminates, for example, sonic bonding as described in U.S. Pat. No. 4,374,888, incorporated herein by reference, is preferred.

Turning to FIGS. 3 and 4, alternative embodiments are illustrated. FIG. 3 is a cross-section similar to FIG. 2 showing a two layer laminate 13 comprised of fine fiber layer 32 and continuous filament layer 36 combined by thermal bond 39. FIG. 4 is a similar view of an alternative three-layer embodiment 15 comprising outer fine fiber layers 32 with inner continuous filament layer 36 combined by thermal bond 37.

In accordance with the invention, the total basis weight of the laminate is in the range generally of less than about 20 gsm most advantageously less than about 15 gsm for personal care products and the amount of fine fibers compared to continuous filaments is at least about 5% generally, and more particularly up to about 25% based on total weight of fine fibers and continuous filaments although even higher proportions of fine fibers will be useful.

The resulting meltblown web 32 with its fine fibers and resulting small pore size distribution has superior barrier properties when incorporated into a fabric laminate. Particularly, the unlaminated meltblown web 32 has an average fiber size of from 5 to 15 microns and pore sizes distributed predominantly in the range from 7 to 12 microns, with

a lesser amount of pores from 12 to 25 microns, with virtually no pores greater than 25 microns, and with the peak of the pore size distribution less than 10 microns.

The present invention can be carried out with polyolefins including predominantly propylene polymer but which may include, polyethylene, or other alphaolefins polymerized with Ziegler-Natta catalyst technology, and copolymers, terpolymers, or blends thereof. Polypropylene is preferred for the continuous filament web.

A lightweight nonwoven laminate was produced generally in accordance with the teachings of U.S. Pat. No. 4,041,203 to Brock and Meitner dated Aug. 9, 1977, incorporated herein in its entirety by reference. An in-line process was utilized as shown in FIG. 1 where the initial layer of spunbond is laid on the forming wire followed by the meltblown layer and finally the final layer of spunbond. The target total basis weight of the fabric was between 25 gsm and 34 gsm with the meltblown making up from between 6 gsm and 12 gsm of the total. For this Example, equal amounts of spunbond were on each side of the meltblown web although not essential to the invention.

The three-layer laminate material was then bonded using a thermal-mechanical bonder as in the above-mentioned U.S. Pat. No. 4,041,203. As is preferred, a pattern bond roll with a percent bond area from 5 to 20%, target of 14%, and with a pin density from 50 to 350 pin/sq. in., target of 225/sq. in. was utilized. The temperature of the system was between 200°F. to 300°F. with a target of 250°F. Bonding pressure was set so that a uniform nip was maintained across the face of the unit.

In accordance with the foregoing an in-line SMS fabric was produced with a total weight of 29 gsm of which 25% was made up of meltblown. The spunbond polymer was Exxon PP3445 polypropylene and the meltblown was Exxon 3495G polypropylene, both of which are available from Exxon Chemical Company. The fabric was then bonded using a "wire weave" pattern roll that had a bond area of 14% with a pin density of 225 pin/sq. in. and was operated at a temperature of 250°F.

Table 1 illustrates the combination of properties obtained with the nonwoven laminate material of Example 1. Basis weight was determined in accordance with ASTM Standard Test D3775-9. Hydrostatic head was determined in accordance with Method 5514 Federal Test Methods STD No. 191A, also AATCC STD 127-1980.

Frazier air porosity was determined in accordance with ASTM D737, also Federal Test Methods 5450 Standard No. 191A. The materials listed in Table 1 were made on a REICOFIL III machine available from Reifeahauser Machinenfabrik of Trolsdorf, Germany.

TABLE 1

Fine Fiber Layer	
Composition	polypropylene
Average fiber diameter (microns)	12
Basis weight (gsm)	2.2
Continuous Filament Layers	
Composition	polypropylene
Average fiber diameter (microns)	20
Basis weight (gsm-each)	4.5
Laminate	
Basis weight (gsm)	11.2
Frazier Porosity (SCFM)	325
Hydrostatic head (mm water)	80
Thickness (microns)	85

When incorporated into a personal care article as a barrier cuff component, the laminate described above demonstrated highly desired functionality and perceived comfort.

In order to improve the containment properties of the disposable diaper, the SMS laminate may be folded or doubled over. This will provide an increased hydrostatic head while not having a significant negative impact on the porosity of the barrier cuff.

Representative Absorbent Article

As used herein, the term "absorbent article" refers to devices which absorb and contain body exudates, and, more specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "disposable" is used herein to describe absorbent articles which are not intended to be laundered or otherwise restored or reused as an absorbent article (i.e., they are intended to be discarded after a single use and, preferably,

to be recycled, composted or otherwise disposed of in an environmentally compatible manner). A "unitary" absorbent article refers to absorbent articles which are formed of separate parts united together to form a coordinated entity so that they do not require separate manipulative parts like a separate holder and liner.

A preferred embodiment of an absorbent article of the present invention is the unitary disposable absorbent article, diaper 100, shown in FIG. 5. As used herein, the term "diaper" refers to an absorbent article generally worn by infants and incontinent persons that is worn about the lower torso of the wearer. It should be understood, however, that the present invention is also applicable to other absorbent articles such as incontinence briefs, incontinence undergarments, incontinence pads, diaper holders and liners, feminine hygiene garments, training pants and the like.

Figure 5 is a perspective view of the diaper 100 of the present invention with portions of the structure being cut-away to more clearly show the construction of the diaper 100. As shown in FIG. 5, the diaper 100 preferably comprises a liquid pervious topsheet 124; a liquid impervious backsheet 126 joined with the topsheet 24 and an absorbent core 128 positioned between the topsheet 124 and the backsheet 126. The diaper 100 is shown in FIG. 5 to have a periphery 129 which is defined by the outer edges of the diaper 100 in which the longitudinal edges are designated 130 and the end edges are designated 132.

FIG. 5 shows a preferred embodiment of the diaper 100 in which the topsheet 124 and the backsheet 126 have length and width dimensions generally larger than those of the absorbent core 128. The topsheet 124 and the backsheet 126 extend beyond the edges of the absorbent core 128 to thereby form the periphery 129 of the diaper 100. While the topsheet 124, the backsheet 126, and the absorbent core 128 may be assembled in a variety of well known configurations, preferred diaper configurations are described generally in U.S. Patent 3,860,003 entitled "Contractable Side Portions for Disposable Diaper" which issued to Kenneth B. Buell on January 14, 1975; and U.S. Patent Application Serial No. 07/715,152, allowed, "Absorbent Article With Dynamic Elastic Waist Feature Having A Predisposed Resilient Flexural Hinge", Kenneth B. Buell et al. filed June 13, 1991; each of which is incorporated herein by reference.

The absorbent core 128 may be any absorbent means which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing

and retaining liquids such as urine and other certain body exudates. The absorbent core 128 has a garment surface, a body surface, side edges, and waist edges. The absorbent core 128 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in disposable diapers and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials; or any equivalent material or combinations of materials. The configuration and construction of the absorbent core may also be varied (e.g., the absorbent core may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may comprise one or more layers or structures). The total absorbent capacity of the absorbent core 128 should, however, be compatible with the design loading and the intended use of the diaper 100. Further, the size and absorbent capacity of the absorbent core 128 may be varied to accommodate wearers ranging from infants through adults. Exemplary absorbent structures for use as the absorbent core 128 are described in U.S. Patent 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman et al. on September 9, 1986; U.S. Patent 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman et al. on June 16, 1987; U.S. Patent 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on December 19, 1989; and U.S. Patent 4,834,735, entitled "High Density Absorbent Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany et al. on May 30, 1989. Each of these patents are incorporated herein by reference.

The backsheet 126 is positioned adjacent the garment surface of the absorbent core 128 and is preferably joined thereto by attachment means such as those well known in the art. For example, the backsheet 126 may be secured to the absorbent core 128 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minnesota and marketed as HL-1258. The attachment means will preferably comprise an open pattern network of filaments of adhesive as is disclosed in U.S. Patent 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola et al. on March 4,

1986, more preferably several lines of adhesive filaments swirled into a spiral pattern such as is illustrated by the apparatus and methods shown in U.S. Patent 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent 4,785,996 issued to Ziecker, et al. on November 22, 1978; and U.S. Patent 4,842,666 issued to Werenicz on June 27, 1989. Each of these patents are incorporated herein by reference. Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

The backsheet 126 is impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials may also be used. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and contours of the human body. The backsheet 126 prevents the exudates absorbed and contained in the absorbent core 128 from wetting articles which contact the diaper 100 such as bedsheets and undergarments. The backsheet 126 may thus comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet is a thermoplastic film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils). The backsheet 126 is preferably embossed and/or matte finished to provide a more clothlike appearance. Further, the backsheet 126 may permit vapors to escape from the absorbent core 128 (i.e., breathable) while still preventing exudates from passing through the backsheet 126.

The topsheet 124 is positioned adjacent the body surface of the absorbent core 128 and is preferably joined thereto and to the backsheet 126 by attachment means such as those well known in the art. Suitable attachment means are described with respect to joining the backsheet 126 to the absorbent core 128. As used herein, the term "joined" encompasses configurations whereby an element is directly secured to the other element by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element. In a preferred embodiment of the present invention, the topsheet 124 and the backsheet 126 are joined directly to each other in the diaper periphery and are indirectly joined together by directly joining them to the absorbent core 128 by the attachment means.

The topsheet 124 is compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet 124 is liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet may be manufactured from a wide range of materials, such as porous foams; reticulated foams; apertured plastic films; or woven or nonwoven webs of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polyester or polypropylene fibers), or a combination of natural and synthetic fibers. Preferably, the topsheet 124 is made of a hydrophobic material to isolate the wearer's skin from liquids contained in the absorbent core 128. There are a number of manufacturing techniques which may be used to manufacture the topsheet 124. For example, the topsheet 124 may be a nonwoven web of fibers spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like. A preferred topsheet is carded and thermally bonded by means well known to those skilled in the fabrics art.

The diaper 100 preferably also comprises elasticized leg cuffs for providing improved containment of liquids and other body exudates. Each elasticized leg cuff may comprise several different embodiments for reducing the leakage of body exudates in the leg regions. (The leg cuff can be and is sometimes also referred to as leg bands, side flaps, barrier cuffs, or elastic cuffs.) U.S. Patent 3,860,003 describes a disposable diaper which provides a contractible leg opening having a side flap and one or more elastic members to provide an elasticized leg cuff (gasketing cuff). U.S. Patent 4,909,803 entitled "Disposable Absorbent Article Having Elasticized Flaps" issued to Aziz et al. on March 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Patent 4,695,278 entitled "Absorbent Article Having Dual Cuffs" issued to Lawson on September 22, 1987, describes a disposable diaper having dual cuffs including a gasketing cuff and a barrier cuff. While each elasticized leg cuff may be configured so as to be similar to any of the leg bands, side flaps, barrier cuffs, or elastic cuffs described above, it is preferred that each elasticized leg cuff comprise an inner barrier cuff 162 comprising a barrier flap and a spacing elastic member. The elasticized leg cuff preferably additionally comprises an elastic gasketing cuff 156 with one or more elastic strands positioned outward of the barrier cuff 162. The inner barrier cuff 162 and preferably the outer gasketing cuff 156 comprise one of the SMS fabric laminate webs 12, 13 or 15 shown in FIGS. 2, 3 and 4.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and

modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. A disposable absorbent article comprising:

a) a liquid pervious topsheet;

b) a liquid impervious backsheet joined to said topsheet;

c) an absorbent material disposed between said topsheet and said backsheet; and;

d) a barrier cuff for enhanced containment, said barrier cuff comprising a nonwoven fabric laminate, said nonwoven fabric laminate comprising:

i) a nonwoven component layer comprising fine fibers having an average diameter in the range of from about 2 microns to about 20 microns and a basis weight of from about 1.5 gsm to about 26 gsm; and

ii) a nonwoven component layer comprising continuous filaments having an average diameter in the range of from about 5 microns to about 30 microns and a basis weight of less than about 4.8 gsm;

wherein said layers are intermittently bonded in a face to face relationship for a total basis weight less than about 20 gsm and the percent of the weight of fine fiber layer to the laminate weight is at least 5%; and

wherein said laminate has a Frazier porosity of at least 50 scfm.

2. The disposable absorbent article of Claim 1 wherein the fine fibers have an average diameter in the range of about 10 microns to about 20 microns and a basis weight between about 1.5 gsm and about 10 gsm; the continuous filaments have an average diameter in the range of about 18 microns to about 25 microns and a basis weight of about 4 gsm to about 4.6 gsm; and wherein the total basis weight of the laminate is less than about 15 gsm.

3. The disposable absorbent article of Claim 1 wherein the continuous filament component layer of said nonwoven fabric laminate comprises a propylene polymer.

4. The disposable absorbent article of Claim 2 wherein the fine fiber component layer of said nonwoven fabric laminate comprises a propylene polymer having a molecular weight distribution between 3.6 and 4.8 Mw/Mn and a melt flow rate up to about 3000 g/10 min. at 230°C.

5. The disposable absorbent article of any of the preceding claims wherein said nonwoven fabric laminate comprises two continuous filament layers on opposite sides of a fine fiber layer and said total basis weight is less than about 15 gsm.

6. The disposable absorbent article of any of the preceding claims wherein the ratio of the fine fibers to continuous filaments is up to about 25%.

7. The disposable absorbent article of any of the preceding claims wherein said absorbent article is a disposable diaper.

8. The disposable absorbent article of any of the preceding claims wherein said nonwoven fabric laminate has a hydrostatic head of at least 40 mm.

9. The disposable absorbent article of any of the preceding claims wherein said nonwoven fabric laminate has a hydrostatic head of at least 50 mm.

10. The disposable absorbent article of any of the preceding claims wherein the nonwoven fabric laminate is folded upon itself.

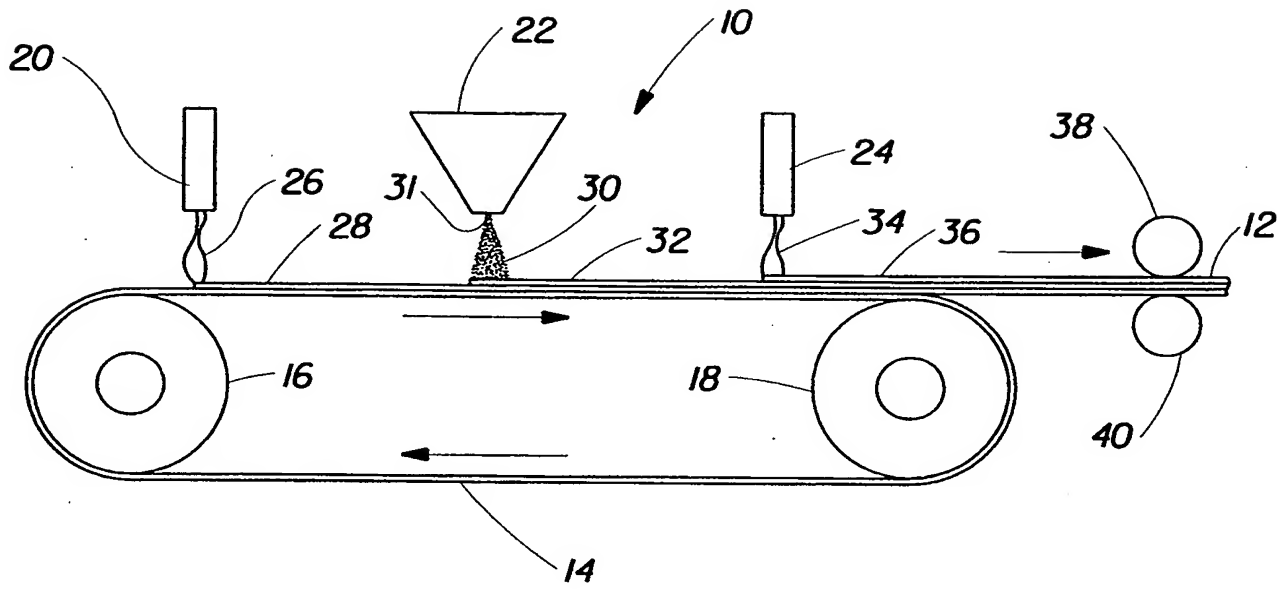

Fig. 1

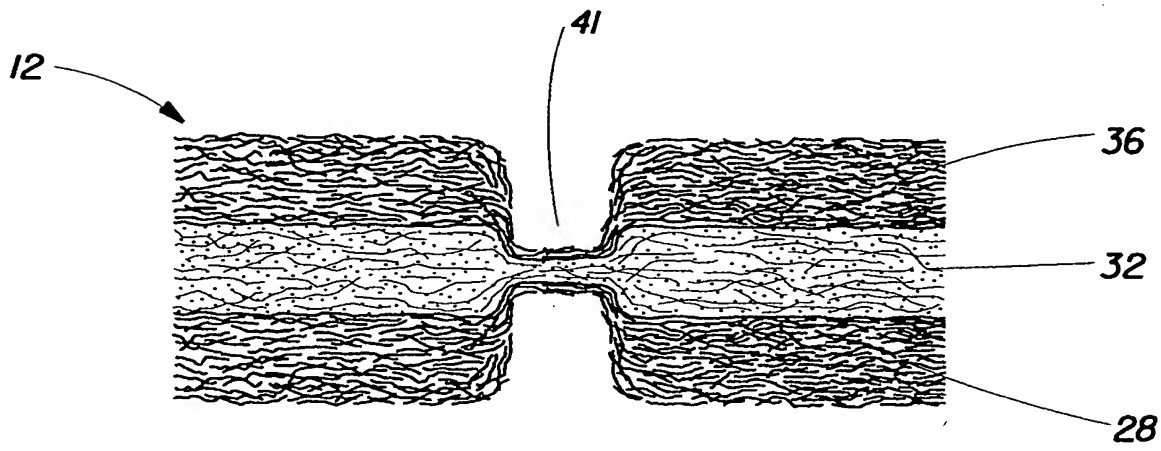

Fig. 2

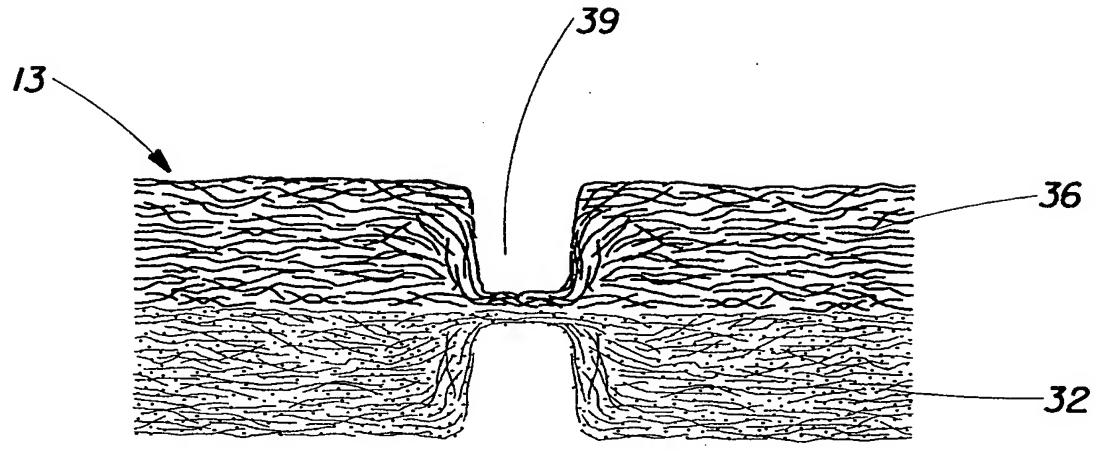

Fig. 3

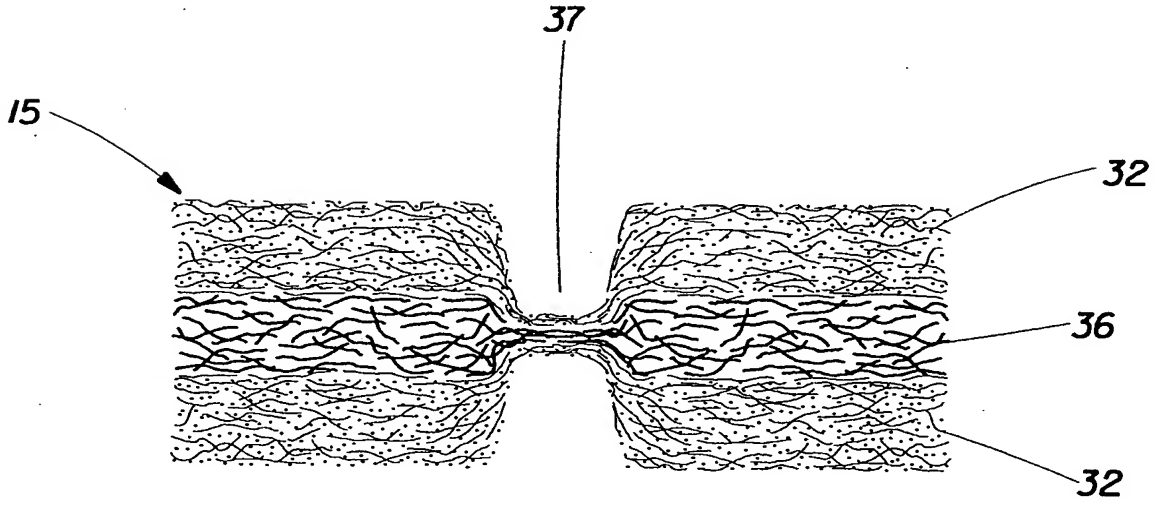

Fig. 4

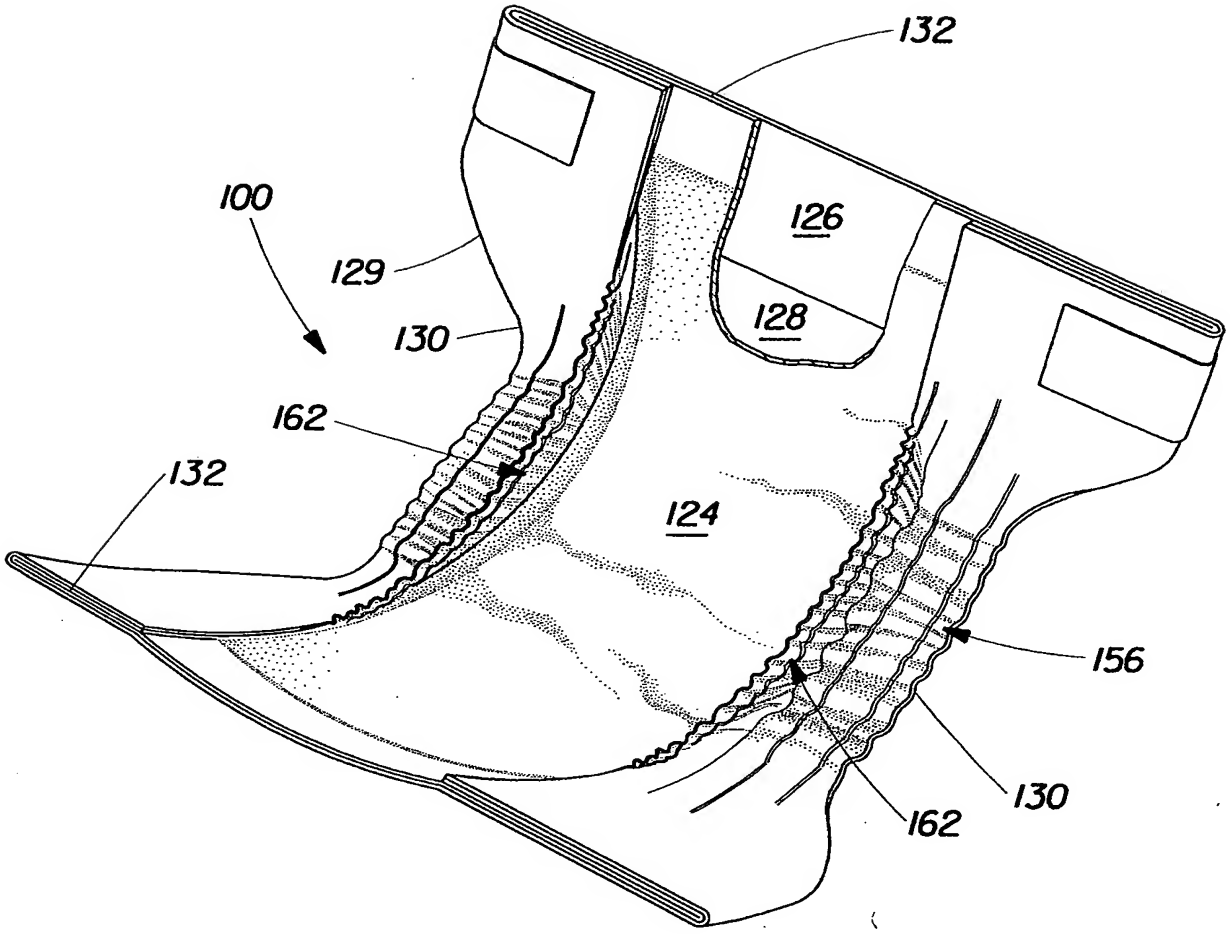

Fig. 5

INTERNATIONAL SEARCH REPORT

Inte. ..ional Application No
PCT/IB 99/00401

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61F B32B D04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 492 751 A (BUTT SR JON R ET AL) 20 February 1996 see abstract see column 6; example 1 see claims 1-3,10	1,3,4, 6-9
A	WO 96 20680 A (KIMBERLY CLARK CO) 11 July 1996 see page 12, line 26 - page 13, line 25	1-10
A	US 4 041 203 A (BROCK ROBERT J ET AL) 9 August 1977 cited in the application see column 7 - column 8; example 1	1
A	US 5 688 157 A (BRADLEY STEPHEN STEWART ET AL) 18 November 1997 see column 7 - column 8; example 2	1

☐ Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 June 1999	09/06/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte. .ional Application No
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